



Plots, Calculations and Graphics Tools (PCG2)

Software Transfer Request Presentation

Presented by

PCG2 Software Development

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Why An Advisory System

- Through time, the need to provide tools that quickly and efficiently facilitate data analysis continues to be a constant, and many times growing demand.
- Engineers must perform data analysis to: confirm system performance, requirement conformance, understand behavior, perform feasibility studies, trends, trouble-shooting and comparisons, potentially across vehicles and missions.
- Data analysis needs may be near real-time, post-test or historical. They may support activities in the Firing Room or in the office area and the users continue to express needs for flexible and agile capabilities.
- Objective Evidence of positions in the form of analyzed data are readily used in program decision-making throughout the centers on a daily basis.
- Manual analysis and interpretation of data like that performed by the Shuttle Program 25+ years ago can be a huge impact on the Engineering workforce and they constantly request methods to help and assist in performing this obligation.

The PCG2 Tool Meets These Needs and More



PCG2 Advisory System

- This easy to use tool provides a single user interface to view data in a pictorial, tabular or graphical format. It allows the user to view the same display and data in the Control Room, engineering office area, or remote sites.
- It supports user defined parameter sets that may be frequently used saving time during operations (For example: predefinition of FDs to be plotted together or predefinition of limit sets).
- Displays can be quickly created and deployed. They are built and tested by the USER without Board control, in an engineering tool box fashion. They may contain animation, embedded calculations and alarms.
 - Embedded Calculations - equations are specified with an easy-to-use syntax for deriving new measurements from calculations on multiple input data.
 - Graphical Animations - animations using either contiguous or non-contiguous character positions as well as animations using graphical images driven by data ranges.



PCG2 Advisory System

- Plotting software provides many capabilities such as trending, data vs. data, zooming, historical overlay and event triggers.
- Fusion and Health information is included in the data stream for display, plotting, recording and retrieval.
- Users can initiate monitoring using a pictorial view (Real Time Display) then view a data element on a graphical plot. Calculations and detailed monitoring or information/data for a specific data item may be easily added.
- PCG2 includes a configuration management deployment tool which updates client workstations automatically with the version dictated by the processing requirements (done automatically at startup).
- Data Stream contains a compact representation of the data and is distributed via IP Multicast
- Security infrastructure has been defined. FTS Server and proxy allows secure transfer of information from the controlled environment to the uncontrolled environment.



Specific Features

A single GUI allows users to select data streams and Display Tools desired to monitor data

The image displays a composite of several software windows from the PCG 2 system, illustrating its specific features. Red arrows indicate the flow of data selection and display control.

PCG 2 Master Control Panel: This window contains several sections:

- Audible Control:** Includes checkboxes for "Alarm Enable" and "Beep Enable", and a "Silence Alarms" button.
- Display Shortcuts:** Features a dropdown menu with "FR1" selected and a "GO" button.
- Real-Time Tool Options:** Includes fields for "Last Stream Used: None" and "Last Channel Used: None", and checkboxes for "Prompt for Different Stream" and "Prompt for Different Display Package".
- Real Time Tools:** Includes buttons for "Start Display", "Start Plot", and "Start DMON".
- Append Description:** A checkbox and a text field.

PCG 2 Data Stream Selection: This window shows a table of available data streams:

#	Location	TCID	Type	Ext	Status
01			CCP	T	
02			CCP	T	
03			CCP	T	
04			CCP	T	
10			RIFO	T	
11			RIFO	T	
13			RIFO	T	
14			RIFO	T	
16			RIFO	T	
22			RIFO	T	
23			RIFO	T	
25			Playback	F	

Weather Overview: This window displays a "Weather Overview" with a central image of a space shuttle launch. It includes data for "Camera Site 6" and "Camera Site 3", such as "Wind Speed 15.4 kt", "Wind Direction 67.0", "Rain Rate 0.0", "Air Temp 64.0", "Relative Humidity 60.4", and "Barometric Pressure 30.4".

Data Stream Selection: This window shows a table of selected data streams:

FD	Value	Time Stamp	Nomenclature	Units
1.158			RPS E1 LND INLET PRESS	PSIA
10.811			RPS E1 LND INLET PRESS	PSIA
9.910			RPS E1 RE SUPPLY BOTTLE PRESS	PSIA
7.119			RPS E2 LND INLET PRESS	PSIA
2.908			RPS E2 LND INLET PRESS	PSIA
0.184			RPS E2 RE SUPPLY BOTTLE PRESS	PSIA
2.020			RPS E2 FRO E RE OUTLET PRESS	PSIA
7.819			RPS F2 FRO E RE OUTLET PRESS	PSIA
2.180			RPS E1 RE SUPPLY BOTTLE PRESS	PSIA
1.318			RPS E2 LND INLET PRESS	PSIA
2.929			WIND DIRECTION CAMERA SITE 3	DEG
2.924			WIND DIRECTION CAMERA SITE 3	DEG
2.928			WIND SPEED CAMERA SITE 3	KT
2.923			WIND SPEED CAMERA SITE 3	KT
1.928			BAROMETRIC PRESSURE CAMERA SITE 3	INHG
4.928			AMBIENT RELATIVE HUMIDITY C SITE 3	PER
0.814			RAIN RATE NEAR CAMERA SITE 3	IN/HR
0.818			RAIN RATE NEAR CAMERA SITE 3	IN/HR
4.922			AMBIENT TEMPERATURE CAMERA SITE 3	DEG
4.924			AMBIENT TEMPERATURE CAMERA SITE 3	DEG
1.927			AIR TEMP SOFT LVL CAMERA SITE 3	DEG
7.972			AIR TEMP SOFT LVL CAMERA SITE 3	DEG

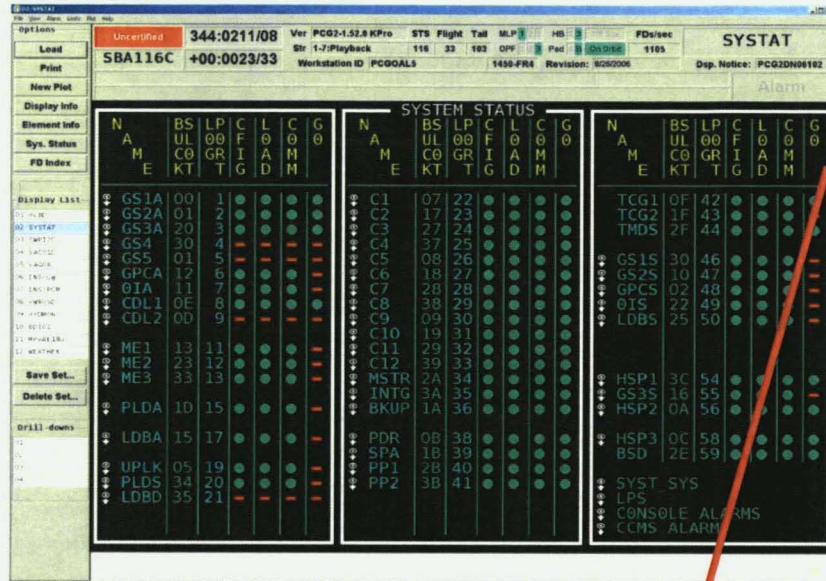
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Specific Features

Additional detailed information is available for specific data items on a display



Edit Limits

The MDE Limits dialog box shows general information and display limits. The General Information section includes Element Name (V76C3095A1), Limit Set Name (Default Limits), and Region. The Display Limits section has a table with columns Value, Enable Beep, and Preview. The table contains rows for High Instrumentation, High Violated, High Warning, Normal, Low Warning, Low Violated, and Low Instrumentation. The Alarm Limits section has Low and High input fields and Visual Enable checkboxes.

Component Status

The Component Status Dialog box shows component information and constituent FD list. The Component Information section includes Description (LO2 98% Level) and Embedded Calculation Formula. The Constituent FD List section has a table with columns FD Name, Nomenclature, Value, Units, Health, and Timestamp. The Associated FD List section has a table with columns FD Name, Nomenclature, Value, Units, Health, and Timestamp.

Element Information

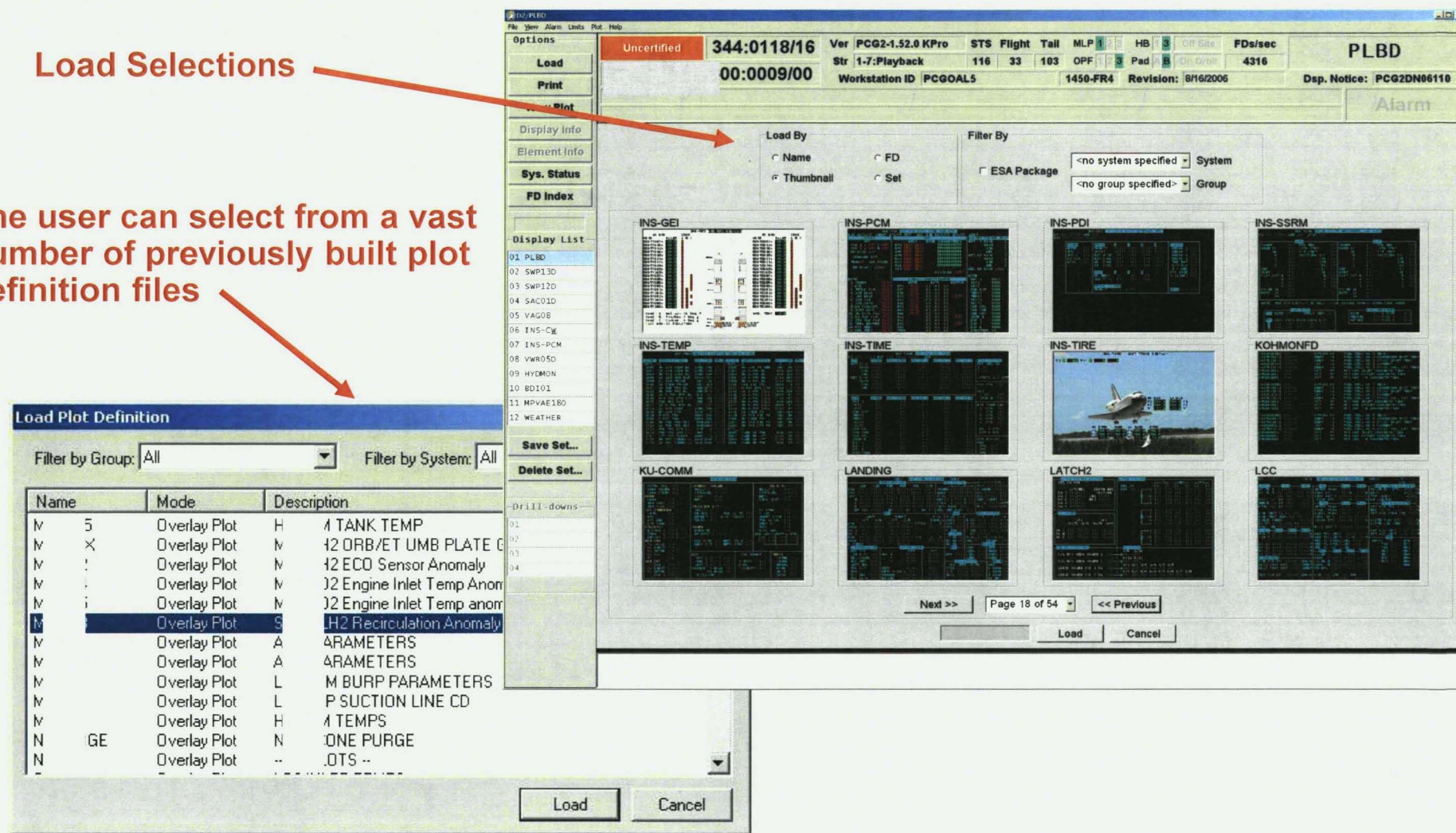
The Element Information dialog box shows element information and FD information. The Element Information section includes Selected Elements (LO298), General Information, Current Value, Health, Location, and Limit Information. The FD Information section includes Name, Nomenclature, Units, Length, Start Bit, Stop Bit, System/Console, Type/Subtype, PCG Type, and Conv. Routine.

Specific Features

Allows user access to predefined parameter sets that are frequently used saving time during operations

Load Selections

The user can select from a vast number of previously built plot definition files



The screenshot displays the PLBD (Plot Load Definition) software interface. The main window shows a grid of plot thumbnails, including INS-GEI, INS-PCM, INS-PDI, INS-SSRM, INS-TEMP, INS-TIME, INS-TIRE, KOHMONFD, KU-COMM, LANDING, LATCH2, and LCC. A red arrow points from the 'Load Selections' text to the 'Load By' section of the main window. Another red arrow points from the 'The user can select from a vast number of previously built plot definition files' text to the 'Load Plot Definition' dialog box.

Load Plot Definition Dialog Box:

Name	Mode	Description
M 5	Overlay Plot	H 1 TANK TEMP
M X	Overlay Plot	M 12 ORB/ET UMB PLATE C
M :	Overlay Plot	M 12 ECO Sensor Anomaly
M :	Overlay Plot	M 12 Engine Inlet Temp Anom
M :	Overlay Plot	M 12 Engine Inlet Temp anom
M :	Overlay Plot	S 12 H2 Recirculation Anomaly
M	Overlay Plot	A 4RAMETERS
M	Overlay Plot	A 4RAMETERS
M	Overlay Plot	L M BURP PARAMETERS
M	Overlay Plot	L P SUCTION LINE CD
M	Overlay Plot	H 1 TEMPS
N GE	Overlay Plot	N ONE PURGE
N	Overlay Plot	-- .OTS --

The main window also features a 'Display List' on the left with items like 01 PLBD, 02 SWP130, 03 SWP120, 04 SAC010, 05 VAG08, 06 INS-CR, 07 INS-PCM, 08 VWR050, 09 HYDMON, 10 BDI01, 11 MPVAE180, and 12 WEATHER. The top status bar shows 'Uncertified 344:0118/16' and '00:0009/00'.

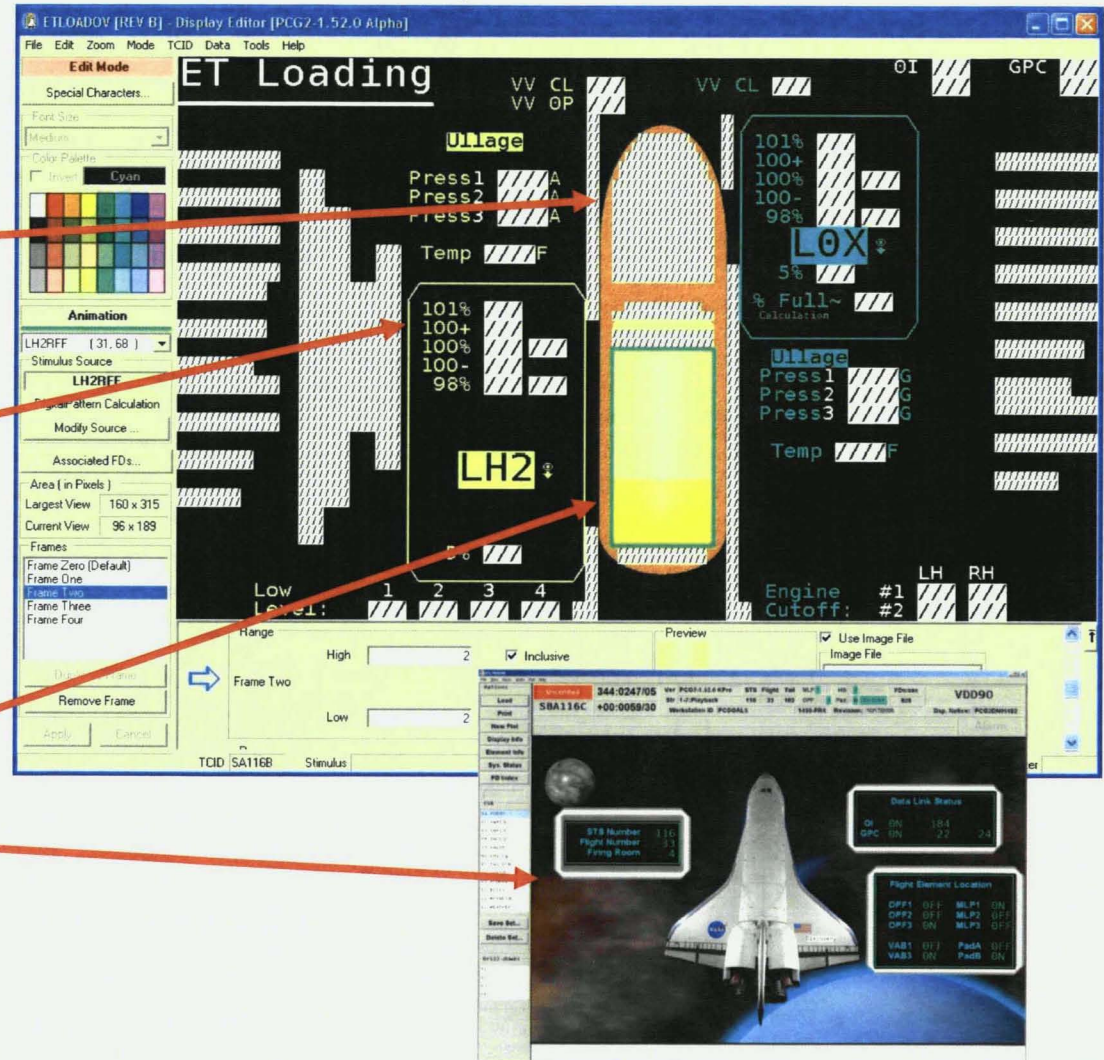
Specific Features

Strong Editor Tool allows efficient display development with capabilities to add embedded calculations, images, animations, drill downs, and other situational awareness enhancements

Tank animation is driven by embedded calculation

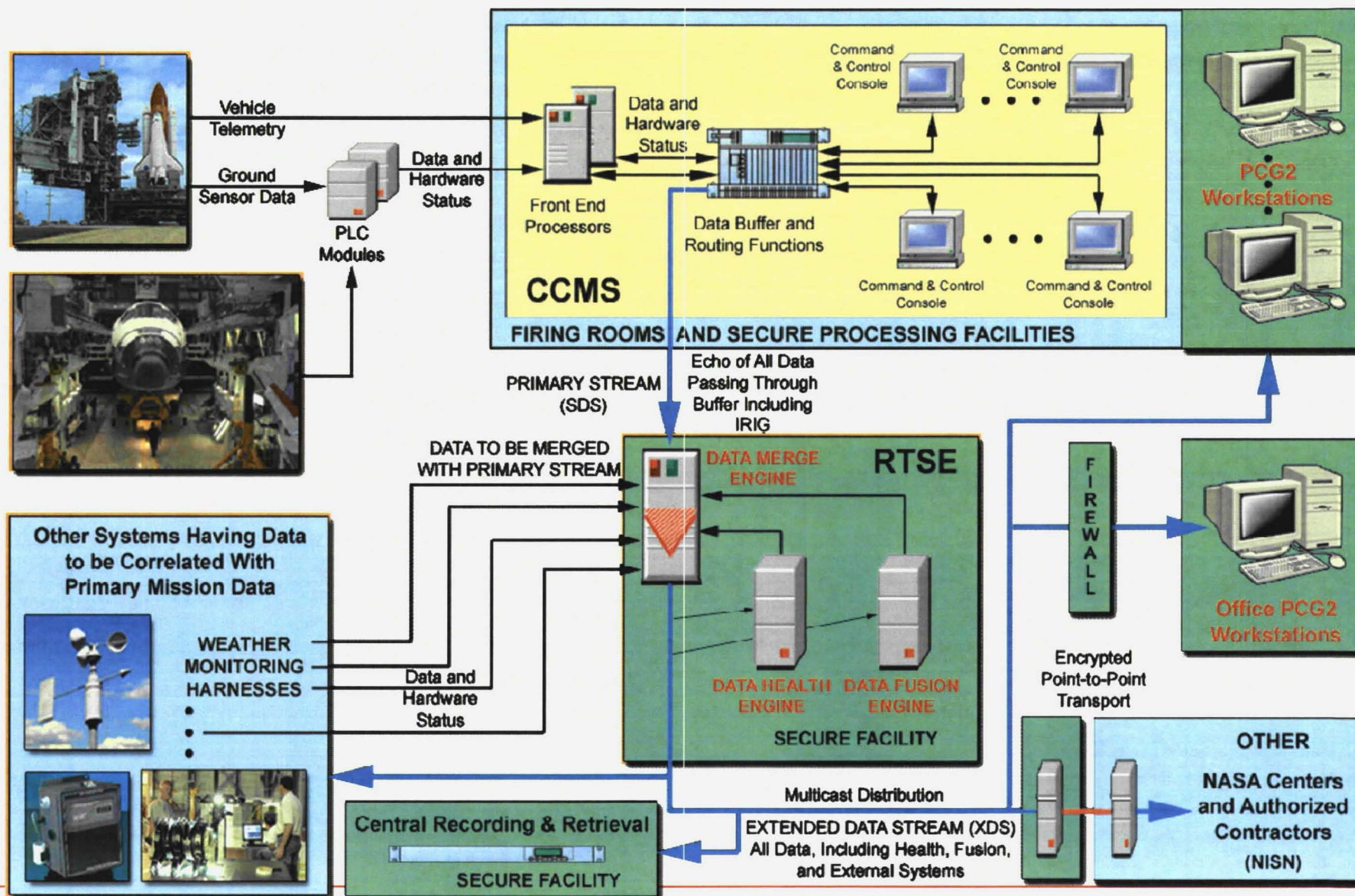
Limits can be adjusted to change color and provide audible alarms

Background Images can be either basic or photo quality

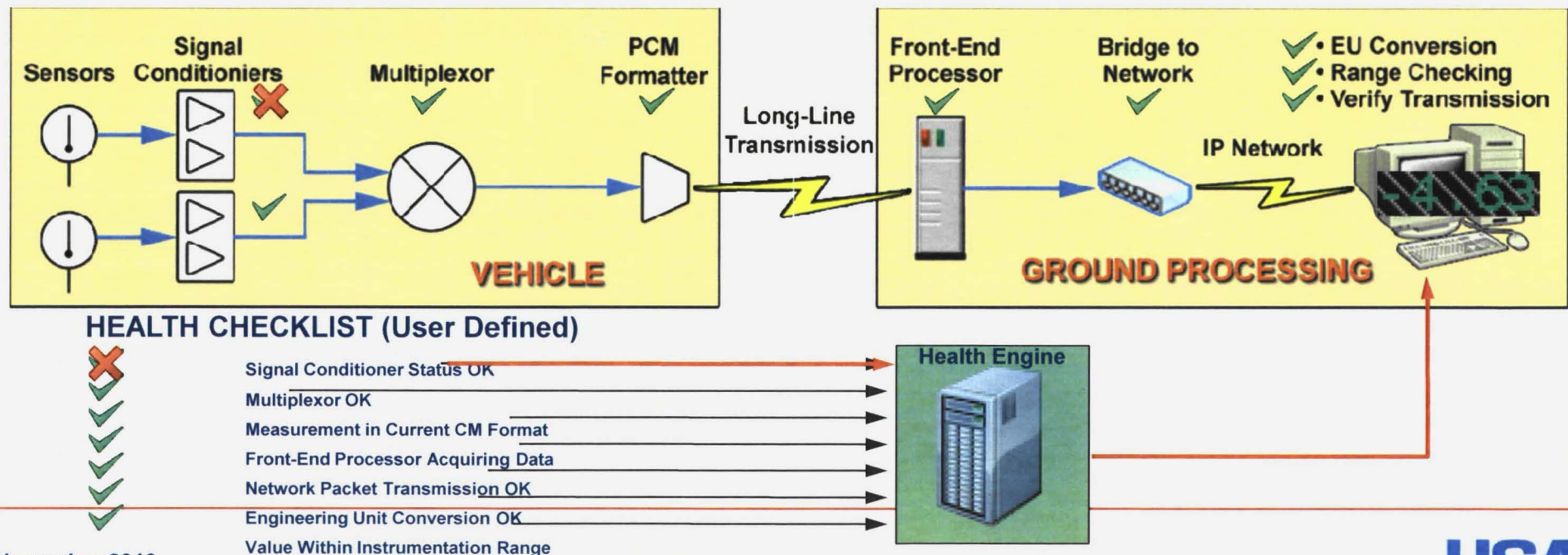




PCG2 With RTSE – Overview



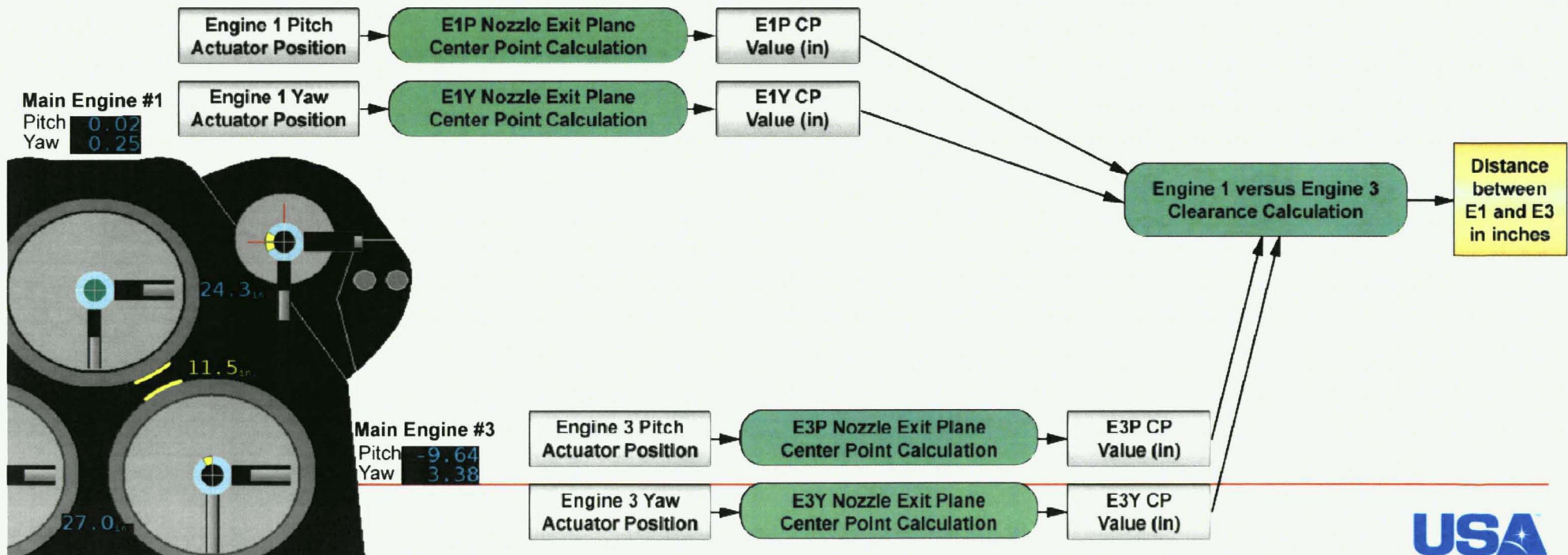
- Each Health Rule captures the in-depth knowledge of the responsible hardware engineer.
- The Health Engine analyzes Health Rules in real time concurrent with vehicle data propagating through the system.
- The Merge Engine integrates Health data with the vehicle data.
- The Merge Engine transmits Health data to a local data center for further analysis.





Fusion Functionality

- Fusion captures the technical knowledge of the engineer which lends to a virtual model of the vehicle.
- Fusion is a centralized computation engine consuming instrumented vehicle data and calculating new derived data.
- The Merge Engine integrates Fusion data with the vehicle data.
- The Merge Engine transmits Fusion data to a local data center for further analysis.





Historical Overlay Functionality



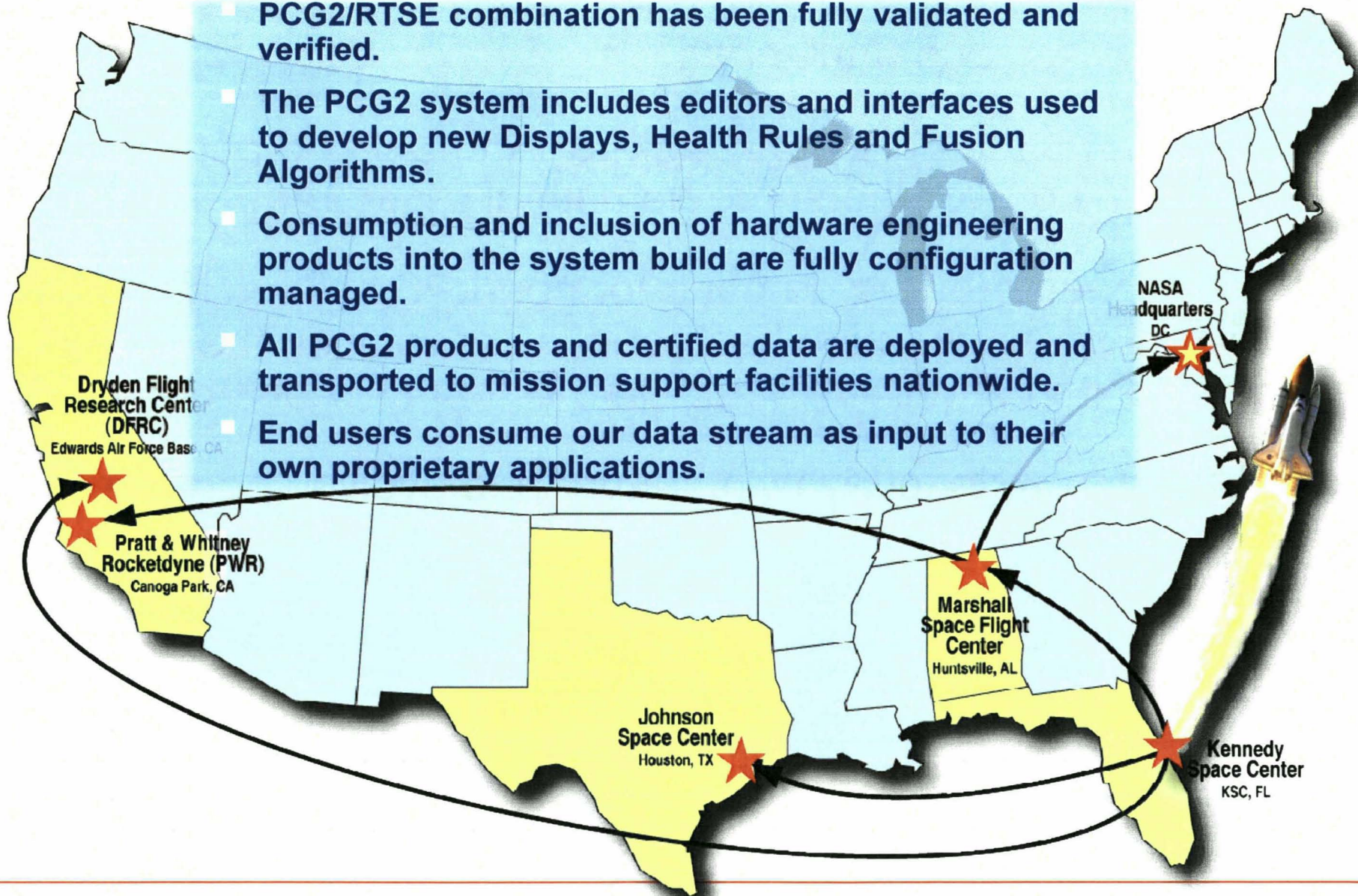
- PCG2/RTSE combination has been fully validated and verified.

- The PCG2 system includes editors and interfaces used to develop new Displays, Health Rules and Fusion Algorithms.

- Consumption and inclusion of hardware engineering products into the system build are fully configuration managed.

- All PCG2 products and certified data are deployed and transported to mission support facilities nationwide.

- End users consume our data stream as input to their own proprietary applications.





Conclusion

- PCG2 supports extensive and regular engineering needs that are both planned and unplanned.
- PCG2 supports the ability to compare, contrast and perform ad hoc data mining over the entire domain of a program's test data.
- There has been growing demand for non-LPS system analysis capability. Experimentation has been successful on the PCG2 merges of external non-LPS data into its data stream today.
- Infrastructure exists today with mature and evolved services.
- Questions and Discussion



Acronyms and Terms:

CCMS	Command Control and Monitoring System
DAP	Data Analysis and Presentation
DMON	Data Monitor
DOS	Disk Operating System
FD	Function Designator (sensors)
FTS	File Transfer Service
GOAL	Ground Operations Aerospace Language
LCC	Launch Commit Criteria
PCG2	Advisory software written as a Windows .NET application
RTD	Real Time Display
RTP	Real Time Plot
RTSE	Real Time Set Engine
SDC	Shuttle Data Center
TCID	Test Configuration Identifier